

powerful lens the three points come out distinctly, and it is then an easy task to eliminate all that does not belong to the heavens.

The construction of such a map, obtained by the apparatus as above described in three hours, would assuredly have demanded several months of assiduous labour by the ordinary processes.

The following is the time of exposure requisite to obtain the image of the stars.¹

Magnitude						h.	m.	s.
1	...	...	...	...	...	0	0	0'005
2	...	...	...	...	...	0	0	0'013
3	...	...	...	...	...	0	0	0'03
4	...	...	...	...	...	0	0	0'08
5	...	...	...	...	...	0	0	0'2
6	{ The extreme limit of magnitude of stars visible to the naked eye }					0	0	0'5
7	...	...	...	...	...	0	0	1'3
8	...	...	...	...	...	0	0	3
9	...	...	...	...	...	0	0	8
10	...	...	...	...	...	0	0	20
11	{ Mean magnitude of the asteroids }					0	0	50
12	...	...	...	...	...	0	2	0
13	...	...	...	...	...	0	5	0
14	...	...	...	...	...	0	13	0
15	{ The last of the stars visible with the aid of the great instruments }					1	23	0
16								

All the above figures represent a minimum. To secure good reproductions on paper the time of exposure would have to be increased threefold.

The above table shows that the time of exposure required in taking a star of the first, and that in taking a star of the last magnitude differ from each other as 1 : 1,000,000. (The relation adopted between the brightnesses of two consecutive magnitudes is 2'542.)

Outside the construction of celestial maps, another field of study of great importance now created by photography may be cited, the discovery, namely, of the asteroids. The little stars fixing themselves on the plate as so many mathematical points, so to say, the planets are distinguished therefrom, each by a little line perfectly defined indicating its proper movement in amount and direction during the time of exposure of the apparatus. It is in this way we have already succeeded in obtaining the trace of a small planet of the 11th magnitude which by a small line extremely well defined gave account of its march among the fixed stars.

It will even be possible to study the movement of the satellites round their planet, and perhaps discover new ones.

The study of the double and multiple stars will be greatly facilitated, and photography will be equally available in the investigation of the parallaxes.

Finally, photometry must be adduced as one of the branches of astronomy which will now be able to collect very valuable information through the utilisation of photography.

In conclusion, it is worth while remarking how this fresh step in advance has sensibly enlarged the scope of man's vision. In consequence of it we can now obtain the image of a star, which instruments of the same opening as those employed by photography would never of themselves have elicited out of their invisibility.

PAUL ET PROSPER HENRY

NOTES

THE first *soirée* of the Royal Society this season took place last night. A large number of Fellows and visitors were present, and many objects of interest were exhibited.

THE visitation of the Royal Observatory by the Board of Visitors is fixed this year for June 5.

¹ For these results we have made use of the gelatino-bromide plates of Monckhoven.

THE Royal Irish Academy is celebrating the centenary of its foundation this week.

DR. GILL, Her Majesty's Astronomer at the Cape, has been elected Corresponding Member of the Imperial Academy of Sciences of St. Petersburg.

THE fifty-seventh anniversary meeting of the Zoological Society was held on Thursday week. The chair was taken by Prof. Flower, LL.D., F.R.S., the President. The report of the Council on the proceedings of the Society during the year was read by Mr. P. L. Sclater, F.R.S., Secretary of the Society. It stated that the number of Fellows on December 31, 1885, was 3193, showing a decrease of 62 as compared with the corresponding period in 1884. The total receipts for 1885 had amounted to 25,809*l.* 10*s.* 1*d.*, being a decrease of 3129*l.* as compared with the previous year. This decrease was mainly due to the falling off in the receipts under the head of admissions to Gardens, and in the amounts received for admission and composition fees from newly elected Fellows. The ordinary expenditure for 1885 had been 24,593*l.* 11*s.* 8*d.*, against 26,539*l.* 4*s.* 1*d.* for 1884. Besides that, an extraordinary expenditure of 491*l.* or 6*d.* had been incurred, which brought up the total expenditure for the year to 25,084*l.* 12*s.* 2*d.* The visitors to the Society's Gardens during the year 1885 had been 659,896, against 745,460 in 1884. The Davis Lectures on zoological subjects, having been well attended during the past year, would be continued during the present season, beginning with a lecture on "Pigs and their Allies," by Prof. Flower, LL.D., F.R.S., on Thursday, June 3, at 5 p.m. The number of animals in the Society's collection on December 31 last was 2551, of which 756 were mammals, 1366 birds, and 429 reptiles. Among the additions made during the past year 21 were specially commented upon as of remarkable interest, and in most cases new to the Society's collection. About 36 species of mammals, 15 of birds, and 4 of reptiles had bred in the Society's Gardens during the summer of 1885. The report concluded with a long list of the donors and their various donations to the menagerie during the past year.

WITH regard to the recent explosion of the 43-ton gun, it is fortunate that it has happened without loss of life. Competent authorities, as seen from Col. A. Moncrieff's letter (which we reproduce from the *Times*) show that it could. How long are our gun factories to go on making guns condemned by easily-understood scientific principles? "Col. Maitland's interesting paper read at the Royal United Service Institution on June 20, 1884," Col. Moncrieff writes, "published the process adopted at Woolwich in settling the types of the new steel breech-loading ordnance for the British service, as well as the proportions of the new guns on these types then in process of manufacture. Mr. W. Anderson's investigations, published in a lecture read before the Society of Arts on January 29, 1885, and also commented upon in the *Engineer* of February 6, 1885, clearly demonstrated that these guns were deficient in strength in front of the trunnions. It is a remarkable fact that several of the guns have now burst at the point and in the manner which could have been predicted by any one consulting Mr. Anderson's demonstrated results. As the subject is of vital importance to the country, it would seem wise either to refute Mr. Anderson or accept his method and consult him; his valuable service in having discovered the prevailing error and worked out this most difficult problem is too little known; it would thus be utilised and acknowledged to the advantage of the service. By treating a gun as a heat-engine and accounting for every part of the energy generated by the explosion of the powder, he has, in a scientific and complete manner, proved that the metal crusher gauges from which the accepted curve of pressure is obtained are not to be relied on.

The form of the guns is adapted to the curve of pressure; that curve, as shown by Col. Maitland at the Royal United Service Institution, is wrong; the maximum pressure which is near the breech is known, but with the slow-burning powder in a long gun the total pressure, and the maximum pressure at any point of the bore, has never been accurately determined. If Mr. Anderson's conclusions carefully arrived at by calculation are correct, these guns are out of proportion between the trunnions and the muzzle, where the bursts have all taken place. Another branch of the same subject is the measurement of the energy of recoil, of much importance in designing disappearing carriages. In this branch, I can answer for it, that Mr. Anderson's conclusions tally with the practical result—a satisfactory proof of their correctness. His discovery is of great practical value in making gun-carriages of all descriptions, and has changed, once and for all, the previously accepted formulæ for the force of recoil given in the text-books, which often led to costly mistakes in construction. Mr. Anderson has been trying, since the publication of his lecture at the Society of Arts, to induce the Government to test the correctness of his views by means of the Sebert velocimeter, but without success. It must be admitted that in determining so important a matter, one on which the efficiency of our ships and a large national expenditure depends, it should be the first desire of every one to secure without delay the highest scientific and practical experience within reach, and to consult men who have devoted special study and research to the subject."

ON April 30 there took place in Paris, at the Ministry of Public Instruction, a meeting of French astronomers. M. Faye was in the chair. It was decided unanimously to build three photographing telescopes. One of these is destined for the Algiers Observatory. The destination of the others will be determined upon when finished. The construction will take eighteen months.

M. JANSSEN has terminated the installation of the tubes for analysing the influence of the atmosphere on spectroscopic analysis, absorbing power, &c. Their length is 100 metres, and they can be filled with gas under a pressure of 100 atmospheres. The light is supplied by a battery of 60 Bunsen elements. Experiments are conducted on nitrogen, oxygen, common air, &c.

HERR PAUL VON RITTER, who died at Basle, has left to the University of Jena a sum of 300,000 marks, to be employed for the furtherance of zoological studies.

CANADA is nearly the only important British colony without its Government Botanic Garden; the identity of its flora with that of the Northern United States rendering such an establishment of much less value than in most of our colonial possessions. But for some years past leading Canadians interested in horticulture have been exerting themselves for the establishment of a Botanic Garden at Montreal. Through the co-operation of the authorities of McGill College and the Council of the Montreal Horticultural Society, this object is now secured, and the "First Annual Report" of the "Montreal Botanic Garden" is issued. The Garden is not yet in existence; but a very favourable site of seventy-five acres has been secured in Mount Royal Park, a varied piece of ground admirably adapted for the purpose, on the slope of the beautiful mountain overlooking the city, from which it derives its name. An Act of Incorporation for the "Montreal Botanic Garden Association" has been obtained, wherein the objects of the corporation are stated to be "By the medium of a Botanic Garden and other accessories, to promote research in forestry and economic botany, and advance the interests of technical and general botanical knowledge." Among the means contemplated in the future for carrying out these objects we are glad to see the establishment of courses of lectures on special subjects and a laboratory for special research.

We wish every success to the new Association, which solicits contributions in trees, shrubs, seeds, and publications.

AT the last general meeting of the Folk-Lore Society, Capt. Temple read a paper on the science of folk-lore. At the conclusion he referred to terminology. Folk-lore, he said, is a fine English compound, but there is a sad want of an alternative, if only for the sake of useful and necessary derivatives. Folk-lore and folk-lore are not pleasant forms, but students have been driven to use both. He suggests some classically-formed synonym, such as *demology*, *demosophy*, or *demonocy*—the last for choice—capable of easy development into passable derivatives, as being of practical use. Dogma has been appropriated already, or *dogmology* might, he thinks, answer, and *demodogmology* is too long. *Dokeology* and *dokesiology*, as the study of fanciful opinions, are also suggested.

IN a recent article in *La Nature* M. Martel refers to a discovery which he has made in the prehistoric caves in Lozère. For fifteen years past Dr. Prunières has prosecuted his investigations into the dolmens and neolithic grottoes of the gorges of the Tarn, and has obtained some curious results on the fusion of a race of the age of polished stones and of an invading race of the Bronze Age. Last year in the cave of Nabrigas, M. Martel found in immediate contact with the remains of at least two skeletons of the *Ursus spelæus*, or great Quaternary bear, nine fragments of human skulls, of which one left superior maxillary had three teeth, and a piece of rough pottery, not turned in a lathe. The question whether, in the Stone Age, man, the contemporary of the reindeer and the great bear, was acquainted with the use of pottery is much debated, eminent names being found supporting the negative as well as the positive. But (continues M. Martel) the curious point about the present find is that fifty years ago, before the birth of "pre-history," when the existence of even Quaternary man was contested, M. Joly found in this very cave of Nabrigas a fragment of a large vessel in contact with the skull of a fossil bear. M. Martel is strongly of opinion that the usual theory of the fortuitous contact of these objects does not apply here; there is no trace of any disturbance, nor are any other neolithic objects found, the skull is in its natural position,—for these and other reasons he is persuaded that fossil man of the palæolithic age was acquainted with the potter's art.

THE fish-hatching season at South Kensington, accounts of which we have published from time to time, is now drawing to a close, although there are still half a million fry on view at the Exhibition which have not yet absorbed their *umbilical sac*. The various species of fish bred have been presented by the National Fish Culture Association to public waters in the vicinity of London and in the country, whilst the Fishery of the Association has been well stocked with fry.

THE Thames Angling Preservation Society, which is ever ready to secure fresh supplies of fish for the Thames, have lately netted one of the ponds in Kew Gardens for this purpose.

DURING the present week large consignments of fish have arrived at the aquarium of the Colonial and Indian Exhibition from the south coast and North Sea. The latest arrivals consist of cod, lings, haddocks, crustaceans of various species, grey mullet, bream, and Salmonidæ. A large Ascension turtle has also arrived in the tropical department, measuring 4½ feet by 3 feet. Considering the protracted period it was out of the water during transit, its condition on being placed in the Chelonian tank did not evidence the slightest signs of diminished vitality, which is another proof of the hardihood and tenacity of life possessed by this species. The turtle tank now contains twenty large specimens of the green and hawksbill kind, all of which seem in good health notwithstanding the artificial existence to

which they are subjected. In contiguity to the tank is a miniature beach whereon the turtle rest when out of water. A consignment of turtle eggs is expected this week, which will be laid out in the hatchery on arrival for the purpose of incubation. Some West Indian tortoises have just arrived, together with a selection of snakes and lizards, which form interesting exhibits. In consequence of the inability of the Royal Commissioners to obtain Indian and Colonial fishes, the National Fish Culture Association have taken the matter into their own hands, and have made arrangements with the Zoological Society in Calcutta and other bodies for supplies of tropical and other piscatorial specimens, so that the aquarium will be supplemented with many rare and important specimens.

MR. OTIS T. MASON's account of the valuable Guesne collection of antiquities in Point-à-Pitre, Guadaloupe, which appeared in the Smithsonian Report for 1884, has recently been issued in separate form. The collection originated with M. Mathieu Guesne, whose series of Carib stone implements attracted considerable attention at the Paris Exhibition of 1867. Since then it has been continued, and all but completed, by the son, M. Louis Guesne, who has devoted nearly twenty years of assiduous labour to the task of rescuing from destruction all existing relics of the ancient Carib race in the Island of Guadaloupe. He has also applied his artistic skill to the illustration of these objects, filling two large albums with aquarelles in natural size and colour of all the types in his museum. From these sources Mr. Mason has mainly compiled the present account, which is enriched with no less than 215 carefully prepared woodcuts of the Point-à-Pitre collection, and of a few others introduced for the purpose of comparison, and to supply omissions in West Indian archæology. The collection includes roughly-worked stones, indicating an industry in its infancy; and others so perfectly finished that it would be difficult to improve upon them either in design or workmanship. But all alike belong to what would be called the Neolithic period in Europe; all the stone implements are polished, and there is not a single object of this class formed solely by being chipped. In fact, the volcanic materials of which they are made cannot be worked by chipping, like flint, quartz, or obsidian. Some, especially, of the axes are so small that they seem to belong to a race of pigmies, while others are so large and heavy that they suggest a generation of Titans rather than of human beings. Besides the movable objects, mention is made of enormous stones carved with strange designs resembling those described by Mr. Im Thurn in British Guiana, some so high up as to be almost out of reach, others close to the ground or buried under the surface. Similar inscribed stones occur in the beds of rivers in the Island of St. Vincent, the last refuge of the Caribs in the West Indies.

HERR SCHÖYEN, in a paper recently reprinted from the *Transactions of the Scientific Society of Christiania*, describes a form of disease affecting the roots of growing barley, through which the farmers in Norway have of late years been suffering extensive loss. Contrary to the common opinion that the ravages due to this blight—which is popularly known as “Krog,” crook, from the form of the deposits—were produced by an insect, Herr Schöyen maintains that this special barley-pest is a microscopic round worm, of the genus *Tylenchus*. After describing the appearance and character of the parasitic germs, which are deposited at the extremities of the roots, where their presence speedily manifests itself by the withering and death of the stalk before the grain can be set, he draws attention to the fact that similar deposits have been noticed on the roots of *Elymus arenaria*, the bind-grass so frequent on the Scotch, as well as the Norwegian, coasts. This observation derives special practical importance from the circumstance that at Lom, in Norway, where the barley crops have

suffered most severely from the “Krog,” the affected fields are in close vicinity to extensive tracts of *Elymus arenaria*. He proposes to continue his observations next summer with special reference to this point, but in the meanwhile he recommends as the only remedy available for the present that barley should not be re-sown on ground where the disease had manifested itself in the preceding season, nor in any locality where *Elymus* abounds. He finds that the bladder-like egg-cases of *Tylenchus hordei* can be thoroughly desiccated without destroying the inclosed worms.

SOME interesting statistics of the Japanese press have lately been published in the *Oesterreichische Monatschrift für den Orient*, in which the newspapers and periodicals of Japan are arranged according to the subjects with which they deal. It appears that 37 publications are devoted to matters connected with education, and that these have a total circulation of 42,649 per month. There are 7 medical papers, with a monthly circulation of 13,514; 9 relating to sanitary matters, with a circulation of 8195; 2 on forestry; and 2 on pharmacy. There are 7 devoted to various branches of science, with a circulation of 2528; but to these must be added 29 engaged in popularising science, with a total circulation of 70,666.

THE additions to the Zoological Society's Gardens during the past week include a Purple-faced Monkey (*Semnopithecus leucopymnus* ♀) from Ceylon, presented by Mrs. Larkins; a Brazilian Tree Porcupine (*Sphingurus prehensilis*) from Brazil, presented by Mr. J. E. Wolfe; two Sloth Bears (*Melursus ursinus* ♂ ♀) from India, presented by Mr. H. Mainwaring; a Burmese Squirrel (*Sciurus atrodorsalis*) from Burmah, presented by Mr. C. Crofton Black; a West Indian Agouti (*Dasyprocta cristata*) from West Indies, presented by Dr. A. Boon, F.R.C.S.; an Orange-thighed Falcon (*Falco fusco-caerulescens*) from Chili, presented by Capt. W. M. F. Castle, R.N.; five Senegal Parrots (*Psephenus senegalus*) from West Africa, presented by Mr. R. B. Sheridan; two Kestrels (*Tinnunculus alaudarius*), British, presented by Mr. J. S. Malcolm; a Wedge-tailed Eagle (*Aquila audax*) from Australia, presented by Mr. R. B. Colvin; a Tuberculated Iguana (*Iguana tuberculata*) from West Indies, presented by Mr. D. Morris; seven European Tree Frogs (*Hyla arborea*), European, presented by Mr. Thompson Hudson; a Californian Quail (*Callipepla californica*) from California, a Herring Gull (*Larus argentatus*), British, presented by Miss Hodge; a Two-banded Monitor (*Varanus salvator*), two Rat Snakes (*Ptyas mucosa*), an Indian Cobra (*Naja tripudians*) from Ceylon, presented by Mr. Carl Hagenbeck; a Moorish Toad (*Bufo mauritanica*) from Italy, a Green Toad (*Bufo viridis*) from Malta, presented by Mr. Alban Doran, F.R.C.S.; two Greek Tortoises (*Testudo graeca*), European, presented by Admiral Mellersh; two Common Vipers (*Vipera berus*), British, presented by Mrs. Mowatt; a Small Hill-Mynah (*Gracula religiosa*), from Southern India, deposited; a Hog Deer (*Cervus porcinus*), seven Long-fronted Gerbilles (*Gerbillus longifrons*), born in the Gardens.

OUR ASTRONOMICAL COLUMN

THE FLEXURE OF MERIDIAN INSTRUMENTS.—In a paper which forms Appendix III. to the “Washington Observations” for 1882, Prof. Harkness has made an exhaustive discussion of the subject of flexure, and the means available for eliminating its effects from star-places. He discusses separately the flexure of transit instruments and of vertical circles. The former are divided into two classes, according as their telescopes are straight or bent, but it is in the latter form that the effects of flexure are by far the greatest, the flexure-coefficients being in some instances as much as 0.55s. Prof. Harkness shows that the effect of flexure cannot be satisfactorily eliminated from the concluded right ascension of a star by simply taking the mean of the four results obtained by observing it directly and by reflect-